Planktonic and benthic foraminifera assemblages from Fantangisña serpentinite mud volcano in the NW Pacific Ocean during the Pleistocene (IODP Expedition 366)

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The Mariana forearc constitutes the southern sector of the Izu-Bonin-Mariana (IBM) trench-arc system (12° N to 35° N) in the NW Pacific Ocean. It is the only setting where active serpentinite mud volcanism is recorded.

The Mariana forearc hosts several large serpentinite mud volcanoes, among which Fantangisña seamount was cored during International Ocean Discovery Program (IODP) Expedition 366. Lithologies comprise pelagic sediments covering serpentinite mud deposits with ultramafic clasts which derive from the subducting Pacific Plate, forearc crust and mantle. In addition, nannofossil-bearing pelagic sediments and volcanic ash/tephra layers were found at the bottom of the core.

Fantangisña seamount is located in the tropical Pacific region, at low latitudes (16° N) within the latitudinal band of the North Equatorial Current (NEC). The NEC is a warm and nutrient-poor water mass, flowing westward in the tropical Pacific Ocean, driven by trade winds.

In this study, benthic and planktonic foraminifera analyses were performed at Site U1498A, located on the southern flank of Fantangisña serpentinite mud volcano. Most of our analysed interval covers the Early to Late Pleistocene as indicated by previous biostratigraphic investigation on this site. Cluster analyses on Pleistocene planktonic foraminifera resulted in two major clusters based on thermocline-dwelling species (e.g., Globorotalia spp.) to mixed-layer dwellers (e.g., G. ruber, G. rubescens, G. glutinata, Trilobatus spp.) ratio, which infer variations of the depth of the thermocline (DOT) during the Pleistocene. These changes of the DOT can be related to fluctuations in the intensity of the NEC. Our data implies a deep and stable thermocline with an intense NEC during the interval of the Early-Middle Pleistocene Transition (EMPT). In contrast, both thermocline and NEC weakened during the Middle-Late Pleistocene, following the EMPT. Variations in strength of the NEC could be associated with ENSO climate conditions (El Niño/La Niña).

Planktonic foraminifera diversity suggests that the distribution of planktonic assemblages was not affected by the serpentinite mud activity in the area. In addition, our results imply that the preservation of the planktonic tests could be enhanced by rapid burial under the serpentinite mud flows.
High diversity (99 taxa) was recorded for benthic foraminifera before and after the serpentinite mud flow volcanism indicating oligotrophic and well-oxygenated bottom-water conditions. In contrast, benthic species were severely affected by the volcanic activity due to serpentinite mud flows and gas emissions.